Commonwealth of Kentucky
Division for Air Quality

PERMIT STATEMENT OF BASIS

Title V/ Title I - PSD, Construction/Operating
Permit: V-14-022 R2
Westlake Chemical OpCo, LP
Calvert City, KY 42029
June 12, 2020
Jacob Zortman, Reviewer

SOURCE ID:	21-157-00080
AGENCY INTEREST:	122899
ACTIVITY:	APE20190002

SOURCE DESCRIPTION:

Westlake Chemical OpCo, LP (Westlake OpCo), Westlake Vinyls, Inc. – Vinyls Plant and Westlake Vinyls, Inc. – PVC Plant are all subsidiaries of Westlake Chemical Corporation (Westlake). The three facilities are located within a contiguous area. Even though the facilities have separate Title V permits, the facilities are a single major source, pursuant to 401 KAR 52:001, Section 1(45)(a) definitions. Each owner/operator is responsible and liable for their own violations, unless there is a joint cause for the violations. Westlake Chemical OpCo, LP, Westlake Vinyls, Inc. – Vinyls Plant and Westlake Vinyls, Inc. – PVC Plant are also a single major source as defined by 401 KAR 52:020, Title V Permits.

The primary function of the Westlake OpCo Plant is to produce high-purity ethylene through thermal cracking of ethane feedstock. The efficiency of this process depends to a great extent on the simultaneous recovery of useful and profitable co-products. These include: propylene, mixed C-4's, aromatic gasoline, fuel oil, and fuel gas.

Process Description:

The ethane feedstock, combined with dilution steam, is introduced into high-temperature furnaces. The furnaces may be fired with a mixture of plant fuel gas, hydrogen gas, and/or natural gas. Furnace design and operating criteria yield optimum effluent compositions while minimizing pyrolysis coke. Upon leaving the furnace, effluent gas is cooled by means of heat transfer to control and stabilize effluent reactions while generating useful energy in the form of steam. This cooling takes place in a series of transfer line exchangers (TLEs) generating saturated 435-psig steam which is then superheated and used to drive the ethylene refrigeration compressor turbine. The turbine exhaust enters the 180-psig steam system, providing much of the 180-psig steam used in the complex.

Once cooled, the furnace effluent stream enters the quench system. The cracked gas enters the system near the bottom of the quench column. Quench water enters the column to scrub oils, tars and carbon particles from the effluent gases as they travel up the column. The water-saturated overhead vapors flow to the feed gas compressor system. The heavy hydrocarbons present in the furnace effluent are condensed in the quench column and mix with the circulating water. The net quench water is drawn from the system and flows to a series of separators and accumulators where light distillate, heavy oil, water and oily water mixtures are segregated. The light distillate is routed to the gasoline column feed tank for processing through the gasoline column.

The heavy oil is transferred directly to the gasoline column. Oily water mixtures flow from the separators directly to the Ethylene Plant's wastewater pretreatment system for removal of any free oil and benzene.

The water-saturated hydrocarbon vapors leave the quench column and enter the multi-stage feed gas compressor system. Injection oil is pumped from a storage tank at regimented flow rates into each stage of compression. This is utilized to prevent the build-up of polymer in the compressor case.

Acid gases generated during the pyrolysis phase are removed to produce high-purity products and co-products. A caustic wash system removes these acid gases between compression stages. Condensed hydrocarbons and spent caustic emulsions from the caustic wash system are transferred to collection tanks for neutralization and then on to the ethylene wastewater pre-treatment unit. The compressed process gas stream is fed to the distillation area.

In the distillation area, the process gas stream enters desiccant dryers. Once dried, the process gas is ready for low temperature processing and separation.

The dried gas stream is pre-cooled in consecutive exchangers before being fed to a series of distillation units including the de-methanizer, de-ethanizer, de-propanizer, propylene column, ethylene column, secondary de-methanizer, de-butanizer column, and gasoline columns. The distillation area also includes acetylene reactors for removing acetylene by reacting it with hydrogen. Separated products from these distillation operations include high-purity ethylene, propylene, mixed C-4’s, aromatic gasoline, fuel oil, and process fuel gas. Ethylene is used as a raw material in the Monomers Plant and process fuel gas is distributed for use as fuel in various combustion units throughout the facility.

The Ethylene Flare is used to burn hydrocarbon streams from the Ethylene Plant. The Ethylene Flare system consists of several blow-down headers, a main header, knockout drum and an air/steam assisted flare stack and routinely burns excess plant process gas, vapors from tank car, barge and tank truck loading/unloading operations, transfer line purges, and vents from various tanks in the plant. The blow-down headers combine and flow down the main header to the flare knockout drum. The knockout drum traps any liquids that may be entrained in the flare feed gas before those liquids can reach the flare stack.

The Ethylene Plant tank farm system consists of four ethylene spheres, four propylene bullets, two C4 spheres, two aromatic gasoline tanks and one fuel oil tank. The gasoline and fuel oil tanks are diked with drains flowing to a NPDES-permitted outfall.

The ethylene wastewater pre-treatment area treats process wastewater and product tank draw down from the Ethylene Plant. Wastewater pre-treatment units include storage vessels, surge control vessels, and oil/water separators. In addition, stormwater and steam trap condensate collected from the various collection pads and sumps in the process area and tank farm can be treated in this unit.

The Ethylene Plant has a dedicated three-sided concrete structure for the water blasting and cleaning of various pieces of equipment. Spills, leaks and cleaning discharges from the pretreatment and water blasting areas flow from these collection areas back to the ethylene wastewater pre-treatment system. Effluent water from the wastewater pre-treatment area is fed to Equalization Tank (EQ Tank) in the Energy and Environmental (E&E) Operations area.

The Ethylene Plant operates Cooling Tower #4A to release the heat rejected from the Ethylene Plant and auxiliary operations.

The Ethylene Plant operates the River Vapor Combustion Unit (VCU) to control emissions from the aromatic gasoline and ethylene fuel oil barge loading operations. It is a natural gas fired unit and typically only operates during times when barges are being loaded. The River VCU is authorized as an alternative control device for the Ethylene wastewater treatment unit at times when the Ethylene Flare is not available.

2020 Expansion Project: V-14-022 R2

The following activities have been incorporated into permit V-14-022 R2: APE20190001 and APE20190002.

APE20190001:

The Division received a notification for a 502(b)(10) change on April 15, 2019. This notification was made to update the non-monitored fugitive counts that are in the Kentucky Emissions Inventory System (KEIS). The non-monitored components (213 gas valves and 763 gas connectors) are in natural gas service, and only emit VOC and methane.

APE20190002:

On May 8, 2019 the Division received an application for a significant revision for the Westlake Chemical OpCo, LP, which includes new equipment and modifications to existing equipment in the Ethylene production plant in order to increase the production capacity from 755 MMlb/yr to 785 MMlb/yr of ethylene. The facility submitted an addendum to the application on January 31, 2020. The new equipment is summarized in Table 1 below, and the upstream and downstream impacts are summarized in Table 2. The list of the equipment to be decommissioned is included in Table 3. Any increases in emissions from this significant revision shall only occur upon issuance of the final permit V-14-022 R2.

Table 1: New Equipment Summary

EPN	Equipment	Description of New Equipment
329	Cracking Furnace #10	150 mmBtu/hr (on a 12-month rolling basis), process fuel gas and natural gas, with low NO_X burners and SCR
321A	New Ethylene Flare	Ground flare or elevated flare, (specifications to be determined)
326A	Ethylene Decoking Pot	New decoking pot (replacing exiting pot) with an integrated scrubber-cyclone designed to control 99.9% of PM, 92.3% of PM_{10} and 81% of $PM_{2.5}$

EPN	Equipment	Description of New Equipment
FUG-ETH-YY	Ethylene Plant Fugitives Subject to YY	Additional components in VOC service will be added - subject to 40 CFR 63, Subpart YY monitoring
FUG-ETH-VVa	Ethylene Plant Fugitives Subject to VVa	Additional components in VOC service will be added - subject to 40 CFR 60, Subpart VVa monitoring
FUG-ETH	Non-Monitored Fugitives in Ethylene	Additional components in natural gas service will be added - which are not subject to any federal rules or LDAR monitoring program
N/A	Compressor	Rotor upgrade on the Expander / Recompressor (included in Fugitives)
N/A	Two (2) Transfer Line Exchangers (TLEs) and associated steam equipment Various relief valves sizing / mitigation changes for the new flare / flare system Aqueous Ammonia Tank for SCR	Included in Fugitives EPs

Table 2: Upstream and Downstream Impacts

EPN	Equipment	Description of Impacts
305 306 307 311	Cracking Furnace #1 Cracking Furnace #2 Cracking Furnace #3 Cracking Furnace #7	Rerate each Furnace (PTE Increase) and Increased Utilization
327 328 314 318 332B 319 320 342	Cracking Furnace #8 Cracking Furnace #9 Reactor Regeneration Heater n-Propanol Tank TK-932 Fuel Oil Tank Tank TK-904A (Gasoline) Tank TK-904B (Gasoline) River VCU	Increased Utilization, No PTE Change
325	Fuel Oil Loading/Unloading	PTE Increase and Increased Utilization
326 331 337 341 376	Ethylene Furnace Decoking Inhibitor Make-up Tank Ethylene Stormwater Tank Fuel Stabilizer Totes Fuel Oil Additive Tote	Insignificant Activity with an Increase in Utilization, No PTE Change

Table 3: Equipment to be Decommissioned

EPN	Equipment	Description of Equipment to be Decommissioned
321	New Ethylene Flare	Existing flare (180 days after startup of EPN 321A)

Project Emission Increase Calculations for the 2020 Expansion project

Pursuant to 401 KAR 51:001, Section 1 Definitions (144)(a), a net emissions increase for any regulated NSR pollutant emitted by a major stationary source means the amount by which the sum of an increase in emissions from a particular physical change or change in method of operation at a stationary source as calculated pursuant to 401 KAR 51:017, Section 1(4), or 401 KAR 51:052, Section 1(2); and any other increases and decreases in actual emissions at the major stationary source that are contemporaneous with the particular change and are otherwise creditable exceeds zero. Generally, baseline actual emissions are subtracted from the projected actual emissions.

Pursuant to 401 KAR 51:001, Section 1 Definitions (20)(b), "Baseline actual emissions" means the rate of emissions, in tons per year, of a regulated NSR pollutant, that the unit actually emitted during any consecutive twenty-four (24) month period selected by the owner or operator within the ten (10) year period beginning on or after November 15, 1990, and immediately preceding the earlier of the date the owner or operator begins actual construction of the project or the date a complete permit application is received by the cabinet for a permit required under 401 KAR 51:017 or 51:052. The Baseline Actual emissions used to calculate the net emissions increase of this project are from January 2016 to December 2017 for all NSR pollutants.

Projected actual emissions (PAE) are calculated by multiplying the baseline emissions by the percent production increase. If the percent increase exceeds the potential to emit (PTE) for the emission unit, then the PTE value is used for the PAE (new units are set to PTE).

The calculated emission increase for the proposed changes associated with the project and the Federal NSR PSD applicability determination for a major modification are shown in Tables 4 through Table 6, and the final determination is summarized in Table 7.

Table 4: Project Emission Increases (tpy)*

	CO	**NO_X**	**SO_2**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO_2e**
Westlake Chemical OpCo, LP	266.92	57.08	0.93	15.76	15.68	12.95	31.68	388,476
Westlake Vinyls, Inc. – Vinyls Plant	87.11	80.77	1.33	15.40	15.35	15.34	24.28	276,712
Westlake Vinyls, Inc. – PVC Plant	19.11	6.01	0.14	11.21	2.14	1.79	15.14	13,487
Totals	373.14	143.86	2.4	42.37	33.17	30.08	71.1	678,675

*Emission increase values are calculated by taking the difference between the PAE and BAE emissions on an individual emission unit basis at each facility

Netting Analysis for NO_X

Westlake has opted to calculate increases and decreases in actual emissions for NO_X, in order to show that the net emissions increase for NOx from the proposed project is not considered a significant increase to trigger further analysis under PSD. All projects at Westlake Chemical OpCo, LP within the contemporaneous period were only increases in utilization, and thus there are no creditable NO_X emissions increases or decreases at this facility. The contemporaneous increases for the Westlake Vinyls, Inc. – Vinyls Plant are shown below in Table 5. Creditable contemporaneous period increases for the Westlake Vinyls, Inc. – PVC Plant are only due to the installation of an emergency generator in November 2015; and are reflected in the NO_X netting analysis summary shown in Table 6.

Table 5: NO_X Netting Analysis Westlake Vinyls, Inc. – Vinyls Plant

EU	EP	Physical or Operational Change Due to Project	Emission Increase* (tpy)
082A	082A	September 2015, #3 Fire Water Pump Engine was installed	0.40
005	009	May 2016, Boiler #2 was installed	30.12
004	012	May 2016, Boiler #5 was decommissioned	-3.24
081A	081A	November 2016, #2 Fire Water Pump Engine was installed	0.34
084	084	September 2016, Emergency Firewater Generator was installed	1.38
085	085	March 2017, Emergency Generator was installed	1.38
CAP	437	October 2017, Catoxid Air Preheater: hours of operation increased from 320 hr/yr to 876 hr/yr.	0.15
088	088	May 2018, Portable Diesel Engine was installed	0.52
CAP	437	January 2019, Hours of operation increased from 876 hr/yr to 8760 hr/yr	3.52
001	008	2020 Expansion Project, Boiler #1 is being decommissioned	-56.08
002	010	2020 Expansion Project, Boiler #3 is being decommissioned	-26.91
003	011	2020 Expansion Project, Boiler #4 is being decommissioned	-183.37

*Westlake has opted to use January 2012 through December 2013 as the basis for the baseline actual emissions for the netting analysis.

Table 6: NO_X Netting Analysis Summary

Facility	Contemporaneous Emission (tpy)
Westlake Vinyls, Inc. – Vinyls Plant	-231.78
Westlake Chemical OpCo, LP	0
Westlake Vinyls, Inc. – PVC Plant	0.19
Total from project emissions increase	143.86
Total Contemporaneous Increases/Decreases	-231.59
Total net emissions increase	-87.73

Table 7: PSD Applicability Evaluation Summary*

Pollutant	Project Increases (tpy)	SER Level (tpy)	Is Netting Required? (Yes/No)	PSD Netting Conducted? (Yes/No)	Is PSD Review Required? (Yes/No)
NO_X	143.86	40	Yes	Yes	No
CO	373.14	100	Yes	No	Yes
VOC	71.1	40	Yes	No	Yes
SO_2	2.4	40	No	No	No
PM	42.37	25	Yes	No	Yes
PM_{10}	33.17	15	Yes	No	Yes
$PM_{2.5}$	30.08	10	Yes	No	Yes
GHG	678,675	75,000	Yes	No	Yes

*Summary is for all three facilities combined (OpCo, Vinyls and PVC) due to prior single source determination

Emissions Data and Calculation Methods: V-14-022 R2

EU# 006C (EPN 329) Cracking Furnace #10:

Cracking Furnace #10 will operate at an annual average firing rate of 150 mmBtu/hr (on a 12-month rolling basis) and an hourly maximum firing rate of 184 mmBtu/hr (on a 24-hour average basis). It will be fired with natural gas and process gas. The furnace will be installed with low NO_X burners and a selective catalytic reduction (SCR) unit to reduce the NO_X emissions. The NO_X and CO emission factors are based on vendor guarantee. Emission factors are 0.0006 lb SO_2/mmBtu, 0.0054 lb VOC/mmBtu and 0.007 lb PM/PM_{10}/$PM_{2.5}$/mmBtu, respectively, based on AP-42, Chapter 1.4. GHG emissions factors are from 40 CFR 98, Subpart C.

EU# 007A (EPN 321A) New Ethylene Flare:

Vent gas to the flare is estimated using historic measurements and the hourly maximum feed rate is based on the manufacturer's design rate of 5,979 mmBtu/hr. The emission factors for NO_X and CO are calculated based on AP-42 Chapter 13.5 and SO_2 emissions are based on AP-42 Chapter 1.4. CO_2 and Methane emissions are calculated using 40 CFR 98, Subpart X, and VOC emissions are calculated using mass balance and a Destruction Removal Efficiency (DRE) of 98%. PM/PM_{10}/$PM_{2.5}$ emissions from the combustion of natural gas in the pilot flame are estimated based on the pilot firing rate of 1.8 mmBtu/hr and an emission factor of 0.0074 lb/mmBtu from AP-42 Chapter 1.4. An alternative operating scenario has been added to the permit, to allow the facility to install either a ground or elevated flare system. Both ground and elevated flare scenarios have been modeled.

(EPN 326A) Ethylene Decoking Pot:

The new decoke pot is operated with an integrated scrubber-cyclone designed to control 99.9% of PM, 92.3% of PM_{10} and 81% of $PM_{2.5}$ per the manufacturer's guarantee. This pot will replace the existing ethylene furnace decoke pot. The emissions of PM/PM_{10}/$PM_{2.5}$ are calculated based on an engineering estimate of the amount of coke built up in the furnace between decoking cycles and the particle size distribution of the discharged coke to the decoke pot. The CO and CO_2 emissions are calculated based on the amount of carbon content in the coke discharged, and the assumption that all coke discharged will be combusted into CO and CO_2 at a ratio of 25% CO and 75% CO_2, and using stoichiometry to estimate the weight of each pollutant discharged.

EU# 005A-D (EPN 305-307, 311) Cracking Furnaces #1, #2, #3 and #7 (existing):

The existing cracking furnaces are fired with natural gas and process gas and are being rerated to a higher hourly and annual firing rate due to recent changes in the process gas composition and heat content. The furnaces have low NO_x burners. The NO_x, CO, VOC and PM/PM_{10}/$PM_{2.5}$ emission factors are based on vendor guarantee. The SO_2 emissions are based on emission factors of 0.0005 lb SO_2/mmBtu from AP-42, Chapter 1.4. GHG emissions are based on the procedures specified in 40 CFR 98, Subpart C. Maximum hourly and annual average ratings for each cracking furnace will be monitored to ensure compliance with the modeling results.

EU# 025, 025A and 025B (EPN FUG-ETH-YY, EPN FUG-ETH-VVa and EPN FUG-ETH) Ethylene Plant Fugitives:

FUG-ETH are the natural gas components in the Ethylene Plant not subject to any federal rules or Leak Detection and Repair (LDAR) monitoring program. FUG-ETH-VVa are the VOC components in the Ethylene Plant subject to 40 CFR 60 Subpart VVa monitoring. FUG-ETH-YY are the VOC components in the Ethylene Plant subject to 40 CFR 63 Subpart YY monitoring. Component counts are based on the assumption that the number of components in VVa service will increase by 5%, the number of components in YY service will increase 2%, and the number of components not subject to an LDAR program will increase 50%. Speciation for components is based on process knowledge. Below in Table 8 through Table 10 is the increase in fugitive components for each category. FUG-ETH-VVa and FUG-ETH-YY do not contain any greenhouse gas emitting components.

Table 8: Changes in Non-Monitored Fugitive Components in Natural Gas Service

Component	Service	Previous Comp. Count	Control Efficiency %	New Emissions VOC lb/hr	New Emissions VOC TPY	New Emissions GHG TPY
Existing Valves	Gas	213	0	0.084	0.37	
Existing Connectors	Gas	763	0	0.089	0.39	
New Valves	Gas	107	97%	3.7×10^{-4}	0.012	0.05
New Connectors	Gas	382	75%	0.011	0.36	1.58

Total Emissions VOC from new Non-Monitored Fugitive Components: 0.37 TPY
Total Emissions VOC from previous Non-Monitored Fugitive Components: 0.76 TPY
Increase in VOC emissions: 0.37 TPY
Increase in GHG emissions: 1.64 TPY

Table 9: Changes in MACT YY Fugitive Components

Component	Service	Previous Comp. Count	New Comp. Count	Control Efficiency* %	New Emissions VOC lb/hr	New Emissions VOC TPY
Valves	Gas	1037	1058	97	0.31	1.34
	LL	1338	1365	97	0.26	1.17
Pump Seals	LL (leakeless)	25	25	100	0	0
	LL	1	1	85	0.005	0.02
Connectors	Gas	6913	7052	75	4.98	21.84
	LL	8920	9099	75	0.81	3.54
Compressor seals		2	2	85	0	0
PRVs		0	0	97	0	0
Open-ended lines		0	0	97	0	0
Sampling connections		0	0	97	0	0

*Control Efficiencies obtained from Texas Commission on Environmental Quality (TCEQ) document "Air Permit Technical Guidance for Chemical Sources: Equipment Leak Fugitives" published June 2018, Appendix A Table I.

Total Emissions VOC from new MACT YY Fugitive Components: 27.65 TPY
Total Emissions VOC from previous MACT YY Fugitive Components: 28.21 TPY
Increase in VOC emissions: 0.56 TPY
Increase in GHG emissions: 0.00 TPY

Table 10: Changes in NSPS VVa Fugitive Components**

Component	Service	Previous Comp. Count	New Comp. Count	Control Efficiency* %	New Emissions VOC lb/hr	New Emissions VOC TPY
Valves	Gas	7426	7798	97	1.74	7.61
	LL	872	916	97	0.20	0.9
Pump Seals	LL (leakless)	28	28	100	0	0
	LL	3	3	85	0.01	0.05
Connectors	Gas	29408	30879	75	16.94	74.18
	LL	2500	2625	75	0.18	0.81
Compressor seals		23	23	85	0	0
PRVs		135	142	97	0.55	2.41
Open-ended lines		0	0	97	0	0
Sampling connections		0	0	97	0	0

*Control Efficiencies obtained from Texas Commission on Environmental Quality (TCEQ) document “Air Permit Technical Guidance for Chemical Sources: Equipment Leak Fugitives” published June 2018, Appendix A Table I.
**There are no batch processes in this facility

Total Emissions VOC from new NSPS VVa Fugitive Components:	85.94 TPY
Total Emissions VOC from previous NSPS VVa Fugitive Components:	81.57 TPY
Increase in VOC emissions:	4.17 TPY
Increase in GHG emissions:	0.00 TPY

BACT applicability:
Each of the proposed new or modified units to be installed as part of 2020 Expansion Project that generate any criteria pollutant (PM, PM_{10}, $PM_{2.5}$, CO, or VOC) emissions or GHG emissions subject to PSD review require BACT review, because the project increases are greater than the significant emission rate (SER) thresholds. Existing emission units at which a net emission increase occurs as a result of a physical change or a change in the method of operation in the unit (per 401 KAR 51:017, Section 8(3)(b)) require a BACT analysis.

EU# 006C (EPN 329) Cracking Furnace #10
A BACT analysis for the proposed ethylene cracking furnace was performed, where control technologies were identified and discussed. The following sections discuss the control options listed in the RBLC as BACT for similar ethylene furnaces.

BACT analysis for Carbon Monoxide (CO) EU# 006C (EPN 329) Cracking Furnace #10:
Control options for CO generally consist of fuel specifications, combustion modification measures, or post-combustion controls. Emission control methods for CO that are commercially available for combustion devices and their feasibility at the facility are explained below:

Use of Natural Gas:

CO emissions with natural gas fired equipment are generally the lowest emission rates achievable because of the combustion efficiency of natural gas. Natural gas is processed to meet certain specifications, including methane content, heating value and sulfur content, that affect combustion efficiency.

The sole use of natural gas is not feasible for the cracking furnace. If fuel gas and process gas are not used in the furnaces, the fuel is required to be flared, increasing the overall emissions from the system, and reducing the overall usage efficiency of the ethylene plant.

Catalytic Oxidation:

Catalytic oxidation of CO gases requires a catalyst bed located in the furnace exhaust. Reduction efficiencies of 90% are typical for CO.

Catalytic oxidation of CO gases requires a location in the exhaust path where flue gas temperatures range from 800 to 1,100°F. The exhaust from the furnace is approximately 1,400°F and is routed through the TLE to recover heat and generate 435 psi steam. The temperature of the exhaust after the heat exchanger is between 400-500°F, which is not within the range for the catalytic oxidation to be effective; therefore, catalytic oxidation is not technically feasible.

Proper Burner Design and Good Combustion Control Practices:

Proper burner design to achieve good combustion efficiency will minimize the generation of CO. Good combustion efficiency relies on both hardware design and operating procedures. A firebox design that provides proper residence time, temperature, and combustion zone turbulence, in combination with proper control of air-to-fuel ratio, is an essential element of a low-CO technology.

Limiting fuel usage at the furnace, ensures that the maximum production efficiency is achieved, while following manufacturer recommendations for burner operation assures that the guaranteed emissions from the furnace will be achieved. There are no detrimental environmental or energy effects related to this control option.

Good Combustion Practices for furnaces include:

1. Calibrations on the excess oxygen analyzer as per the manufacturer’s recommendations;
2. Calibrations and filter checks on the fuel gas analyzer as per the manufacturer’s recommendations;
3. Calibration of the fuel gas flow meter as per the manufacturer’s recommendations;
4. Inspect the burners and clean / replace components as per the manufacturer’s recommendations;
5. Inspect the burner flame pattern and adjust as per the manufacturer’s recommendations; and
6. Inspect the furnace, insulation, piping and refractory and repair / replace components as per the manufacturer’s recommendations.

Selection of BACT

Westlake OpCo will utilize clean, gaseous fuel and good combustion practices with no add-on controls, and numerical emissions limits of 0.013 lb CO/mmBtu and 8.54 tons per year, based on fuel heat value of 448 mmBtu/mmscf, as BACT for CO emissions from the Cracking Furnace #10.

BACT analysis for PM, PM_{10}, and $PM_{2.5}$ EU# 006C (EPN 329) Cracking Furnace #10:

Control options for particulate matter generally consist of fuel specifications, combustion modification measures, or post-combustion controls. Emission control methods that are commercially available for combustion devices and their feasibility at the facility are explained below:

Use of Natural Gas:

PM emissions with natural gas fired equipment are generally the lowest emission rates achievable because of the combustion efficiency of natural gas. Natural gas is processed to meet certain specifications, including methane content, heating value and sulfur content, that affect combustion efficiency.

The sole use of natural gas is not feasible for the cracking furnace. If fuel gas and process gas are not used in the furnaces, the fuel is required to be flared, increasing the overall emissions from the system, and reducing the usage efficiency of the plant.

Post Combustion PM Control

The typical controls for post-combustion particulate matter are baghouses, electrostatic precipitators (ESP), cyclones, and scrubbers. ESPs are used exclusively on very high volume, high particulate loaded vents, commonly associated with combustion of solid fuels such as coal. Likewise, cyclones and scrubbers are used only in situations with high flows and high PM loadings. Combustion of gaseous fuels does not fit into this category; therefore, add-on controls are not a technically feasible option for the furnace.

Proper Burner Design and Good Combustion Control Practices:

Proper burner design to achieve good combustion efficiency will minimize the generation of particulates. A firebox design that provides proper residence time, temperature, and combustion zone turbulence, in combination with proper control of air-to-fuel ratio, is an essential element of low PM generation.

Proper design of burner and firebox components in the heaters and boilers will provide the proper air-to-fuel ratio, proper residence time, temperature, and combustion zone turbulence essential to maintain low particulate emission levels.

Good Combustion Practices for furnaces include:

1. Calibrations on the excess oxygen analyzer as per the manufacturer’s recommendations;
2. Calibrations and filter checks on the fuel gas analyzer as per the manufacturer’s recommendations;
3. Calibration of the fuel gas flow meter as per the manufacturer’s recommendations;
4. Inspect the burners and clean / replace components as per the manufacturer’s recommendations;
5. Inspect the burner flame pattern and adjust as per the manufacturer’s recommendations; and
6. Inspect the furnace, insulation, piping and refractory and repair / replace components as per the manufacturer’s recommendations.

Selection of BACT

Westlake OpCo will utilize clean, gaseous fuel and good combustion practices with no add-on controls, and numerical emissions limits of 0.007 lb PM/PM_{10}/$PM_{2.5}$/mmBtu and 4.6 ton/yr on a 12-month rolling basis of PM/PM_{10}/$PM_{2.5}$, based on fuel heat value of 448 mmBtu/mmscf. The burner manufacturer expects 0.001 lb PM/PM_{10}/$PM_{2.5}$/mmBtu from the burners.

BACT analysis for Volatile Organic Compounds (VOC) EU# 006C (EPN 329) Cracking Furnace #10:

Control options for VOC generally consist of fuel specifications, combustion modification measures, or post-combustion controls. Emission control methods for VOC that are commercially available for combustion devices and their feasibility at the facility are explained below:

Use of Natural Gas:

VOC emissions with natural gas fired equipment are generally the lowest emission rates achievable because of the combustion efficiency of natural gas. Natural gas is processed to meet certain specifications, including methane content, heating value and sulfur content, that affect combustion efficiency.

The sole use of natural gas is not feasible for the cracking furnace. If fuel gas and process gas are not used in the furnaces, the fuel is required to be flared, increasing the overall emissions from the system, and reducing the usage efficiency of the plant.

Catalytic Oxidation:

Catalytic oxidation of VOC requires a catalyst bed located in the boiler exhaust. Reduction efficiencies of 90% are typical for VOC.

Catalytic oxidation of VOC gases requires a location in the exhaust path where flue gas temperatures range from 800 to 1,100°F. The exhaust gas is used for the boiler's FGR and the temperature is approximately 245°F after it is used as FGR. The temperature of the exhaust is not warm enough for the catalytic oxidation to be effective; therefore, catalytic oxidation is not technically feasible.

Proper Burner Design and Good Combustion Control Practices:

Proper burner design to achieve good combustion efficiency will minimize the generation of VOC. Good combustion efficiency relies on both hardware design and operating procedures. A firebox design that provides proper residence time, temperature, and combustion zone turbulence, in combination with proper control of air-to-fuel ratio, is an essential element of a low- VOC technology.

Proper design of burner and firebox components in the heaters and boilers will provide the proper air-to-fuel ratio, proper residence time, temperature, and combustion zone turbulence essential to maintain low VOC emission levels. Because proper burner design and operation promotes low VOC emissions, there are no detrimental environmental or energy effects related to this control option.

Good Combustion Practices for furnaces include:

1. Calibrations on the excess oxygen analyzer as per the manufacturer's recommendations;
2. Calibrations and filter checks on the fuel gas analyzer as per the manufacturer's recommendations;
3. Calibration of the fuel gas flow meter as per the manufacturer's recommendations;
4. Inspect the burners and clean / replace components as per the manufacturer's recommendations;

5. Inspect the burner flame pattern and adjust as per the manufacturer's recommendations; and
6. Inspect the furnace, insulation, piping and refractory and repair / replace components as per the manufacturer's recommendations.

Selection of BACT

Westlake OpCo will utilize clean, gaseous fuel and good combustion practices with no add-on controls, and numerical emissions limits of 0.0054 lb VOC/mmBtu and 3.54 tons per year on a 12-month rolling basis, based on fuel heat value of 448 mmBtu/mmscf.

BACT analysis for Greenhouse Gases (GHGs) EU# 006C (EPN 329) Cracking Furnace #10:

Possible control strategies for GHG as listed in the RBLC consist of proper combustion design and control, use of gaseous fuels, improved combustion measures (i.e., combustion tuning, optimization, and installation of instrumentation and controls); insulation; and operational monitoring and proper maintenance to minimize air infiltration.

Carbon Capture with Transportation and Dedicated Sequestration:

Carbon capture and sequestration (CCS) can make a contribution to the overall GHG reduction effort by reducing the emissions of CO_2 from the use of fossil fuels. Most of the technologies needed for CCS are being used in a variety of industries but are yet to be widely applied to industry at a commercial scale. Because CCS is not commercially available, it is not a feasible control option.

Selection of Low-Carbon, Gaseous Fuels:

The use of gaseous fuels with low carbon content and high heat intensity is an appropriate BACT for GHG. Because the sole use of natural gas is not a feasible option for the cracking furnace, as it reduces the overall usage efficiency of the ethylene plant, only process gas will be combusted.

Proper Boiler and Burner Design:

The efficiency of the furnace will have an impact on the overall efficiency of the facility and thus an impact on total GHG emissions. Efficient design improves mixing of fuel and creates more efficient heat transfer. In general, a more energy efficient combustion technology burns less fuel and reduces the production of GHG and other regulated air pollutants.

The proposed cracking furnace will be designed to optimize combustion efficiency. Maximizing combustion efficiency reduces the consumption of fuel by optimizing the quantity of usable energy transferred from the fuel to the process. Proper design of burner and firebox components in the furnace will provide the proper air-to-fuel ratio, proper residence time, temperature, and combustion zone turbulence essential to maintain low CO_2 emission levels.

Good Combustion Practices:

The use of good combustion practices can minimize the potential GHG emissions associated with incomplete combustion. Good combustion practices typically entail introducing the proper ratio of combustion air to the fuel, maintaining a minimum temperature in the firebox of the combustor, or a minimum residence time of fuel and air in the combustion zone. By employing good combustion practices, GHG emissions may be greatly reduced.

Preventative maintenance of the furnaces includes calibration of fuel gas flow meters and oxygen control analyzers, cleaning of burner tips and cleaning of convection section tubes. These activities insure maximum thermal efficiency is maintained.

Good Combustion Practices for furnaces include:
1. Calibrations on the excess oxygen analyzer as per the manufacturer's recommendations;
2. Calibrations and filter checks on the fuel gas analyzer as per the manufacturer's recommendations;
3. Calibration of the fuel gas flow meter as per the manufacturer's recommendations;
4. Inspect the burners and clean / replace components as per the manufacturer's recommendations;
5. Inspect the burner flame pattern and adjust as per the manufacturer's recommendations; and
6. Inspect the furnace, insulation, piping and refractory and repair / replace components as per the manufacturer's recommendations.

Selection of BACT
To minimize GHG emissions, Westlake OpCo will utilize the following control methods:
1. Utilizing clean, gaseous fuel;
2. Good heater design, including insulation and minimization of potential for air infiltration;
3. Good combustion practices and proper burner design and operation;
4. Proper furnace operation and maintenance; and
5. Preheating of combustion gases through a heat recovery system to reduce heat load and fuel consumption at the furnace.
6. Maintaining a minimum thermal efficiency of 87%.
7. 30,500 tons per year on a 12-month rolling basis of CO_2e.

Table 11 EU# 006C (EPN 329) Cracking Furnace #10 BACT Summary

Pollutant	BACT Determination	BACT Limit
CO	1. Good combustion practices and proper operation and maintenance. 2. Use of fuel gas and natural gas fuel.	0.013 lb/mmBtu and 8.54 tons per year on a 12-monh rolling basis.
PM PM_{10} $PM_{2.5}$	1. Good combustion practices and proper operation and maintenance. 2. Use of fuel gas and natural process gas fuel.	0.007 lb/mmBtu and 4.6 tons per year on a 12-month rolling basis of PM and PM_{10} and $PM_{2.5}$.
VOC	1. Good combustion practices and proper operation and maintenance. 2. Use of fuel gas and natural process gas fuel.	0.0054 lb/mmBtu and 3.54 tons per year on a 12-month rolling basis.
GHG	1. Good combustion practices and proper operation and maintenance. 2. Use of fuel gas and natural process gas fuel. 3. Improved combustion measures. 4. Minimizing air infiltration. 5. Insulation.	30,500 tons per year on a 12-month rolling basis, based on Equation 5 from 40 CFR 98.33(a)(3)(iii)

EPN 326A Ethylene Decoking Pot
A BACT analysis for the proposed decoking pot was performed, where control technologies were identified and discussed. The following sections discuss the control options listed in the RBLC as possible BACT for similar decoking operations.

BACT analysis for PM, PM_{10}, and $PM_{2.5}$ EPN 326A Ethylene Decoking Pot:
Control options for particulate matter generally consist of baghouses, electrostatic precipitators (ESP), cyclones, and scrubbers. Emission control methods that are commercially available for decoking operations and their feasibility at the facility are explained below:

Baghouses and ESPs:
Baghouses and EPSs are used to control PM in high loading, lower moisture streams. Because the decoking operation consumes a high quantity of steam and the decoking effluent is high in moisture, baghouses and ESPs are not a technically feasible option.

Cyclones and Scrubbers:
Cyclones and scrubbers are used only in situations with high flows sand high PM loadings. Because the moisture content will not allow for the use of baghouses or ESPs, the use of a combination of cyclones and scrubbers will be used for BACT for the decoking operation,

Selection of BACT
The use of a high efficiency integrated scrubber-cyclone and good engineering / combustion practices in the furnaces, to limit the amount of coke build up is considered BACT. The decoking pot will be subject to a 20 percent opacity limit based on an average of six-minute period.

BACT analysis for CO and Greenhouse Gasses EPN 326A Ethylene Decoking Pot:
Control options for CO generally consists of combustion management measures to prevent CO formation or post-combustion controls. Emission control methods that are commercially available to control CO and CO2e emissions from decoking devices include:

Carbon Capture with Transportation and Dedicated Sequestration:

Carbon capture and sequestration (CCS) can make a contribution to the overall GHG reduction effort by reducing the emissions of CO_2 from the use of fossil fuels. Most of the technologies needed for CCS are being used in a variety of industries but are yet to be widely applied to industry at a commercial scale. Because CCS is not commercially available, it is not a feasible control option.

Good Combustion Practices:

The use of good combustion practices in the furnaces can minimize the amount of coke build up in the furnace tubes and limit the hours of the decoking operation. Good combustion practices typically entail introducing the proper ratio of combustion air to the fuel, maintaining a minimum temperature in the firebox of the combustor, or a minimum residence time of fuel and air in the combustion zone. By employing good combustion practices, GHG emissions may be greatly reduced.

Good Combustion Practices for furnaces include:

1. Calibrations on the excess oxygen analyzer as per the manufacturer’s recommendations;
2. Calibrations and filter checks on the fuel gas analyzer as per the manufacturer’s recommendations;
3. Calibration of the fuel gas flow meter as per the manufacturer’s recommendations;
4. Inspect the burners and clean / replace components as per the manufacturer’s recommendations;

5. Inspect the burner flame pattern and adjust as per the manufacturer's recommendations; and
6. Inspect the furnace, insulation, piping and refractory and repair / replace components as per the manufacturer's recommendations.

Proper Boiler and Burner Design:

The efficiency of the furnace will have an impact on the overall efficiency of the facility and thus an impact on total GHG emissions. Efficient design improves mixing of fuel and creates more efficient heat transfer. In general, a more energy efficient combustion technology burns less fuel and reduces the production of GHG and other regulated air pollutants. Maintaining proper design parameters in the furnace to maximize the efficiency, will limit the amount of coke build up and limit the number of decoking operations.

Selection of BACT

To minimize CO and CO_2e emissions, Westlake OpCo will implement good engineering / combustion practices in the furnaces, in order to control the amount of coke build up and limit the hours of the decoking operation. The RBLC does not contain any verified CO emission limitations for decoking operations.

Table 12 EPN 326A Ethylene Decoking Pot BACT Summary

Pollutant	BACT Determination	BACT Limit
PM PM_{10} $PM_{2.5}$	1. Integrated high-efficiency scrubber. 2. Good engineering and combustion practices.	20% Opacity
CO		None; TPY calculated.
GHG		932 tons per year of CO_2 on a 12-month rolling basis.

Equipment Leak Fugitives EU# 025, 025A and 025B (EPN FUG-ETH-YY, EPN FUG-ETH-VVa and EPN FUG-ETH)

Westlake OpCo submitted a BACT analysis for the proposed fugitive components, where control technologies were identified and discussed. The following sections discuss the control options listed in the RBLC as possible BACT for similar ethylene facilities.

BACT analysis for Volatile Organic Compounds (VOC) Fugitives EU# 025, 025A and 025B (EPN FUG-ETH-YY, EPN FUG-ETH-VVa and EPN FUG-ETH):

The primary control strategy is an effective leak detection and repair (LDAR) program. The requirements for such programs are defined in the federal and state regulations. All such programs require identification of equipment in VOC service, periodic monitoring of equipment depending upon its component type and service (i.e., liquid service, gas service etc.), a suitable definition of a "leaking" component (i.e., a threshold concentration of VOC defined as a leak), deadlines for efforts to repair and completion of repair, requirements to monitor repaired components to verify repair, and appropriate recordkeeping and reporting to the agency. Emission control methods that are commercially available for fugitive emissions and their feasibility at the facility are explained below:

Use of Leakless Technology for Some Components:

Leakless technology valves are designed to be used in situations where highly toxic compounds are present. Leakless equipment is not available for all components that may have fugitive emissions, so another program is also required for LDAR for such components. Further, leakless valves cannot be repaired without a unit shutdown. Components in the Ethylene Plant are not considered to be highly toxic; thus, these fluids do not warrant the additional risks associated with a unit shutdown for repair. For this reason, leakless valve technology is considered to be technically infeasible.

Directed Maintenance with LDAR Monitoring Program

Directed maintenance with LDAR monitoring programs is primarily used to provide additional control for a specific compound that require additional emission reductions in order to pass health impacts. Specifically, directed maintenance is used to address off property impact problems associated with piping fugitive emissions from specific compounds and fugitive emissions subject to nonattainment new source review permitting actions. An air toxics analysis has been performed showing no problems with any off property air impacts and the facility is not a nonattainment area, therefore directed maintenance is not applicable.

Use of Lower Leak Definitions with LDAR Monitoring

Instrument-based LDAR, following the federal NSPS and MACT regulations and lower leak definition of 500 ppm for light liquid pumps is an effective means to reduce VOC leaks.

Use of a Leak Detection and Repair (LDAR) Program with Instrument Sensors Together with Established Federal or State Requirements for Identification of Fugitive Components, Specified Monitoring Schedules, Repair Deadlines and Recordkeeping and Reporting Requirements:

Use of instrument LDAR programs, alternative remote sensing LDAR programs and LDAR programs consisting of audio/visual/olfactory monitoring are considered to be technically feasible.

Use of an Alternative Monitoring Program using Remote Sensing Technology such as Infrared Cameras along with Repair Deadlines and Appropriate Recordkeeping and Reporting:

Use of instrument LDAR programs, alternative remote sensing LDAR programs and LDAR programs consisting of audio/visual/olfactory monitoring are considered to be technically feasible.

Instrument LDAR programs and alternative remote sensing programs have been deemed equally effective by EPA, provided certain protocols are followed with respect to the remote sensing programs. Olfactory observation is an effective practice for locating natural gas leaks due to the odorization requirements for natural gas; however, audio, visual, olfactory observation based LDAR programs are not as effective as instrument based or remote sensing programs.

For piping components that will only be in odorized natural gas service, EPA has determined that an LDAR program based on audio/visual/olfactory practices is as effective as any other type fugitive control program.

Using a remote sensing or infrared camera system, does not quantify the size or concentration of a leak, and because an instrument based LDAR program is already required at the facility, the use of an alternative monitoring system is not feasible.

LDAR Program with Method 21-Compliant Analyzers

An LDAR program with Method 21- compliant analyzers, together with established federal or state requirements for identification of fugitive components, specified monitoring schedules, repair deadlines and recordkeeping and reporting requirements is the most effective control for leaking fugitive components.

Good Work Practices

Good work practices include:

1. Construction of new and reworked piping, valves, pump systems, and compressor systems shall conform to applicable American National Standards Institute (ANSI), American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), or equivalent codes based on the material.
2. New and reworked buried connectors shall be welded.
3. To the extent that good engineering practice will permit, new and reworked valves and piping connections shall be reasonably accessible for leak checking during plant operation.
4. Damaged, leaking, or severely rusted valves, connectors, compressor seals, agitator seals, and pump seals found by visual inspection to be leaking (e.g., process fluids) shall be tagged and replaced or repaired. All leaking components that cannot be repaired until a scheduled shutdown shall be identified for such repair by tagging.
5. Open-ended lines are required to be equipped with a cap, plug, blind flange, or second valve.
6. New relief valves are required to vent to a control device for any potential releases and as a result, any fugitive emissions are reduced. Exceptions may be made if venting relief valves to control will result in a safety concern, but this does not exempt the company from controls such as equipping the valve with a rupture disk and pressure-sensing device.

Selection of BACT

Westlake OpCO will use the most stringent VOC based instrument monitoring system applicable to the new components shown in Table 8, Table 9 and Table 10, as BACT and will implement the following:

1. Following 40 CFR 63, Subpart YY and 40 CFR 60, Subpart VVa LDAR programs as required by the regulations, and promptly repairing any leaking components in accordance with the LDAR plan.
2. Leak defined as 500 ppmv.
3. Westlake OpCo will install leakless pumps with dual mechanical seals or with a barrier fluid to reduce leaks, as possible. If a leakless pump is not feasible, the permittee shall submit justification as to its technical infeasibility.
4. Westlake OpCo will monitor new non-leakless pumps to a leak detection threshold of 500 ppmv.
5. Westlake OpCo will utilize Good Work Practices.

BACT analysis for Greenhouse Gases (GHGs) Fugitives EU# 025B (EPN FUG-ETH):

The fugitive emissions controls presented in this analysis will provide similar levels of emission reduction for both CO_2 and CH_4 from the FUG-ETH components; therefore, the BACT evaluation for these two pollutants has been combined into a single analysis. The following available control technologies were identified:

Use of Leakless Technology for Some Components

Leakless or low-leak equipment is not available for all components that may have fugitive emissions and their use is significantly limited by material of construction considerations and process operating conditions, so another program would also be required for the majority of components for which leakless or low-leak technology is not applicable. Leakless or low-leak technology valves are designed to be used in situations where highly toxic compounds are present. Further, leakless or low-leak valves cannot be repaired without a unit shutdown. Natural gas streams are not considered to be highly toxic; thus, these fluids do not warrant the additional risks associated with a unit shutdown for repair. For these reasons, leakless or low-leak valve technology is considered to be technically infeasible.

Directed Maintenance with LDAR Monitoring Program

Directed maintenance with LDAR monitoring programs is primarily used to provide additional control for a specific compound that require additional emission reductions in order to pass health impacts. Specifically, directed maintenance is used to address off property impact problems associated with piping fugitive emissions from specific compounds and fugitive emissions subject to nonattainment new source review permitting actions. An air toxics analysis has been performed showing no problems with any off property air impacts and the facility is not a nonattainment area, therefore directed maintenance is not applicable.

Implementing various Leak, Detection and Repair (LDAR) programs in accordance with applicable State and Federal Air Regulations:

LDAR programs have traditionally been developed for controlling Volatile Organic Compound (VOC) emissions. Monitoring direct emissions of CO_2 is not feasible with the normally used instrumentation for fugitive emissions monitoring. Despite this, instrumented monitoring is technically feasible for components in CH_4 service.

Use of an Alternative Monitoring Program using Remote Sensing Technology such as Infrared Cameras along with Repair Deadlines and Appropriate Recordkeeping and Reporting.

Using a remote sensing or infrared camera system, does not quantify the size or concentration of a leak which are needed to trigger further monitoring and repair requirements. Furthermore, there are currently no federally mandated programs that allow Remote Sensing Technology without also including Method 21 monitoring other than OOOOa.

An LDAR Program using Routine Inspection Plus Audio/Visual/Olfactory (AVO) Walk Arounds (Sensory monitoring only, as Distinguished from Instrument Detection)

Leaks could be detected and promptly repaired, while taking the appropriate recordkeeping and reporting requirements, however AVO observation-based LDAR programs are not as effective as instrument-based or remote sensing programs for non-odorous chemicals. Furthermore, non-odorized natural gas can be purchased by the facility.

LDAR Program with Method 21-Compliant Analyzers

An LDAR program with Method 21- compliant analyzers, together with established federal or state requirements for identification of fugitive components, specified monitoring schedules, repair deadlines and recordkeeping and reporting requirements is the most effective control for leaking fugitive components.

Good Work Practices

Good work practices include:

1. Construction of new and reworked piping, valves, pump systems, and compressor systems shall conform to applicable American National Standards Institute (ANSI), American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), or equivalent codes based on the material.
2. New and reworked buried connectors shall be welded.
3. To the extent that good engineering practice will permit, new and reworked valves and piping connections shall be reasonably accessible for leak checking during plant operation.
4. Damaged, leaking, or severely rusted valves, connectors, compressor seals, agitator seals, and pump seals found by visual inspection to be leaking (e.g., process fluids) shall be tagged and replaced or repaired. All leaking components that cannot be repaired until a scheduled shutdown shall be identified for such repair by tagging.
5. Open-ended lines are required to be equipped with a cap, plug, blind flange, or second valve.
6. New relief valves are required to vent to a control device for any potential releases and as a result, any fugitive emissions are reduced. Exceptions may be made if venting relief valves to control will result in a safety concern, but this does not exempt the company from controls such as equipping the valve with a rupture disk and pressure-sensing device.

Selection of BACT

Westlake OpCo will use the most stringent VOC based instrument monitoring system applicable to the new components in natural gas service (EPN FUG-ETH), as BACT for GHG and will implement the following:

1. Westlake OpCo will use instrument based LDAR consistent with the requirements for gas/vapor valves and connectors subject to the requirements of 40 CFR 60, Subpart VVa.
2. Westlake OpCo will utilize good piping design and good work practices.
3. Westlake OpCo will install high quality/compatible components designed with gaskets and other materials of construction for the service for which they are intended, providing long term control.

Table 13 EU# 025 025A and 025B (EPN FUG-ETH-YY FUG-ETH-VVa and FUG-ETH) BACT Summary

Pollutant	BACT Determination
VOC	1. LDAR program with instrument sensors together with 40 CFR 63, Subpart YY and 40 CFR 60, Subpart VVa requirements as applicable. 2. Leak as defined as a reading of 500 ppmv. 3. Use of leakless pumps with dual mechanical seals or with a barrier fluid to reduce leaks. 4. New non-leaking pumps to a leak detection threshold of 500 ppm. 5. Good work practices.

Table 14 EU# 025B FUG-ETH BACT Summary

Pollutant	BACT Determination
VOC	1. LDAR program with instrument sensors consistent with 40 CFR 60, Subpart VVa 2. Good piping design and work practices. 3. Installation of high quality/compatible components to provide long term control. 4. Leak as defined as a reading of 500 ppmv.
GHG	

New Ethylene Flare EU# 007A (EPN 321A)
A BACT analysis was performed for the proposed new ethylene flare, where control technologies were identified and discussed. The following sections discuss the control options listed in the RBLC as BACT for similar ethylene flare systems.

With this project, the existing elevated ethylene flare will be replaced with either a new elevated flare or a new ground flare, at a different location. Westlake is currently working with the EPA on a consent decree, regarding the proposed flare and the details of the new flare will be updated with a minor revision. Ground flare and elevated flares were evaluated separately but were determined to have the same BACT determinations.

BACT analysis for Carbon Monoxide (CO) and Volatile Organic Compounds (VOC) EU# 007A (EPN 321A):
The following potential control strategies for the flare were considered as part of this BACT analysis:

Good Process Design

Minimization of the amount of gases going to flare is considered Good Engineering Practice (GEP) and shall be specified for the proposed project.

Best Operational Practices and Flare Minimization

Best operational practices can be described in unit startup and shutdown procedures. System pressures and temperatures will be monitored to minimize flaring, and monitoring will be available to prevent bypass to atmosphere from the process. Best operational practices will include good flare design, pilot flame monitoring, flow measurement, and monitoring/control of waste gas heating valve

Good Flare Design

For the proposed project, both ground flares and elevated flares will be installed depending on which option is most efficient for the selected process design. A ground flare employs pressure control valves, ensuring a smaller flow of assist gas relative to an elevated flare, which requires a greater flow of natural gas to maintain velocity.

Selection of BACT
Westlake OpCo will employ good flare design, minimize the amount of gases going to flare and use the appropriate instrumentation, control and best operational practices as best available control options for reducing flare emissions.

BACT analysis for Greenhouse Gases (GHGs) EU# 007A (EPN 321A):
CO_2 and N_2O emissions from flaring process gas are produced from the combustion of carbon

containing compounds (e.g., CO, VOCs, CH_4) present within the process gas streams and the pilot fuel. GHG emissions from the flare are based on the estimated flow rates of CO_2 and flared carbon containing gases derived from heat and material balance data.
The following potential GHG control strategies for the flare were considered as part of this BACT analysis:

Good Process Design

Minimization of the amount of gases going to flare is considered GEP and shall be specified for the proposed project.

Best Operational Practices

Best operational practices can be described in unit startup and shutdown procedures. System pressures and temperatures will be monitored to minimize flaring, and monitoring will be available to prevent bypass to atmosphere from NG systems. Best operational practices include pilot flame monitoring, flow measurement, and monitoring/control of waste gas heating valve.

Good Flare Design

For the proposed project, both ground flares and elevated flares will be installed depending on which option is most efficient for the selected process design. A ground flare employs pressure control valves, ensuring a smaller flow of assist gas relative to an elevated flare, which requires a greater flow of natural gas to maintain velocity. Compared with an elevated flare, the ground flare will emit approximately ten times less CO_2 from combustion of assist gas.

Use of Low Carbon Assist Gas

Fuels containing lower concentrations of carbon generate less CO_2 emissions than higher carbon fuels. Pursuant to 40 CFR 98, Subpart C, Table C-1, NG is among the lowest carbon fuel listed and is the lowest carbon fuels available for the proposed project.

Selection of BACT

Westlake OpCo will employ low carbon assist gas, good flare design, minimize the amount of gases going to flare and use the appropriate instrumentation, control and best operational practices as best available control options for reducing flare GHGs.

Good Combustion Practices include:

1. Good air/fuel mixing, residence time, fuel supply, optimum temperature and oxygen levels will be controlled as required to maintain efficiency and guaranteed performance.
2. Preventative maintenance of the flares includes calibration of fuel gas flow meters and cleaning of burner tips.

BACT analysis for Particulate Matter (PM/PM_{10}/$PM_{2.5}$) EU# 007A (EPN 321A):

Particulate emissions from the flaring process are a result of unburned fuel used in the pilot flame.

Good Process Design

Minimization of the pilot gas is considered good engineering practice.

Best Operational Practices

Best operational practices include pilot flame monitoring.

Good Flare Design

Both ground flares and elevated flares are being considered for the proposed project, and final selection will be made with the most efficient for the process. A ground flare will employ pressure control valves, ensuring a smaller flow of assist gas relative to an elevated flare.

Use of Low Carbon Pilot Gas

The pilot will burn only natural gas, and pursuant to 40 CFR 98, Subpart C, Table C-1, natural gas is one of the lowest carbon fuels listed, and is the most available for the proposed flare installation.

Selection of BACT

Westlake OpCo will employ natural gas as a pilot fuel, good flare design, the use of appropriate instrumentation, control and best operational practices as BACT for reducing PM/PM_{10}/$PM_{2.5}$ emissions from the pilot flame of the flare.

Table 15 New Ethylene Flare EU# 007A (EPN 321A) BACT Summary (Ground or Elevated Flare)

Pollutant	BACT Determination
CO VOC GHG PM PM_{10} $PM_{2.5}$	1. Complying with 40 CFR 60.18 and 40 CFR 63.11. 2. Good plant design to minimize flaring. 3. Good flare design and operation.

PSD Modeling Analysis:

The incremental increases in ambient pollutant concentrations associated with the Westlake Chemical Corporation (Westlake) project will be estimated through the use of the American Meteorological Society / Environmental Protection Agency Regulatory Model (AERMOD) Version 19191 applied in conformance to applicable guidelines. A protocol was prepared following Appendix W, as published in Federal Register on January 17, 2017.

The Division's net emission increase calculations differ slightly from those performed by Westlake; however, the represented emission increases in the modeling demonstration performed by Westlake are conservative. The Division believes the modeling has sufficiently represented that there will be no impacts on NAAQS for the area.

Model simulations for short-term and annual-averaged CO, PM_{10}, and $PM_{2.5}$ emissions are performed with AERMOD using the 5-year meteorological database. For each pollutant, the maximum value over 5 years for each applicable time averaging period is compared to the appropriate SIL.

Table 16 SIL Results for PSD NAAQS

Pollutant	Averaging Period	Model Conc. ($\mu g/m^3$)	SIL ($\mu g/m^3$)	Secondary $PM_{2.5}$ Conc. ($\mu g/m^3$)	Total Conc. ($\mu g/m^3$)	Percent of Threshold (%)	Additional Review Required?
PM_{10}	24-hour	1.7565	5	N/A	1.7565	35.13	No
	Annual	0.2834	1	N/A	0.2834	28.34	No
$PM_{2.5}$	24-hour	1.1569	1.2	0.0045	1.1614	96.78	No
	Annual	0.2748	0.3*	0.0007	0.2755	91.83	No
CO	1-hour	372.50	2000	N/A	372.50	18.63	No
	8-hour	73.79	500	N/A	73.79	14.76	No

Note: Section 2.1.1 of the PSD Air Quality Analysis Report received by the Division in March 2020 and updated in May 2020 provides the justification to use a $PM_{2.5}$ annual SIL of 0.3 $\mu g/m^3$.

As a part of significant impact analyses, the ambient impacts from the proposed project must also be compared against the associated SMCs in Table 17 to determine if preconstruction monitoring is required for pollutants whose impacts are above their respective SMCs. Table 17 compares the predicted off-property concentrations to the associated SMCs. As shown in Table 17, CO 8-hour and PM_{10} 24-hour-concentraions are below the SMC thresholds; therefore, preconstruction monitoring is not expected to be required.

Table 17 Pre-construction Monitoring Analyses Results

Pollutant	Averaging Period	SMC Model Concentration ($\mu g/m^3$)	SMC Threshold ($\mu g/m^3$)	Percent of Threshold (%)	Additional Review Required?
PM_{10}	24-hour	1.7565	10	17.57	No
CO	8-hour	73.7947	575	12.83	No

Class I Area Analysis

Class I area impacts are addressed if the proposed project has an impact that exceeds the screening threshold as described by Federal Land Managers' (FLM) Air Quality Related Values Work Group (FLAG) guidance. In this guidance the sum of the proposed project emissions (in tons per year) of SO_2, NO_x, PM_{10} and H_2SO_4 is divided by the distance to the Class I area and compared to the value of 10. This ratio is known as Q/D. If Q/D is 10 or less, the project is considered to have a negligible impact on the Class I area. If the Q/D value is greater than 10, then further analysis to evaluate impacts in the Class I area is warranted.

There is only one Federal Class I area within 300 km of the Westlake: Mingo National Wildlife Refuge in Missouri at 150 km. The sum of emissions (SO_2, NO_x, PM_{10} and H_2SO_4) for the proposed project is 41.36 tons/year. The calculated Q/D for the proposed project relative to Mingo National Wildlife Refuge is 0.276; as such no additional evaluation of Class I area impacts are required.

Table 18 Class I Area Q/D Screening Analysis

Pollutant	Project Emissions (tons/year)	Q/D Analysis
NO_2	0.0*	
SO_2	6.76†	
PM_{10}	34.60	
H_2SO_4	0.0	
Total	41.36	
Mingo National Wildlife Refuge	150 km	0.276

* The NO_X project net emissions increase is negative (i.e., a decrease) so zero (0) is conservatively used for NO_X in the sum for Q instead of the negative number.

† The SO_2 emission rate listed is the site-wide PTE after the project instead of just the project increase.

In addition, receptors are placed at 48, 49 and 50 kms due west of the facility to show concentrations that could be expected towards the Mingo National Wildlife Refuge. Table 19 shows the maximum concentrations at the 48, 49 and 50 km receptors.

Table 19 Receptors Towards Mingo National Wildlife Refuge

Pollutant	Averaging Period	48 km Model Concentration (µg/m³)	49 km Model Concentration (µg/m³)	50 km Model Concentration (µg/m³)	Total Conc. Percentage (%)
PM_{10}	24-hour	0.0618	0.0586	0.0689	1.38
	Annual	0.0031	0.0031	0.0031	0.31
$PM_{2.5}$	24-hour	0.0447	0.0435	0.0434	3.73
	Annual	0.0037	0.0036	0.0036	1.23
CO	1-hour	16.7894	16.5081	16.3133	0.84
	8-Hour	8.1254	7.9914	7.8551	1.63

A cursory review of the elevations for distances of 48 km, 49 km and 50 km was performed and the elevations from 48 km to 50 km in most cases are decreasing. It was concluded that the elevations are not definitive enough to be the cause of the increase in concentrations at those receptors. The total concentration percentage of the SIL at 50 km for each pollutant and averaging period is also provided in Table 19. The concentrations are still well below the SIL as the impacts are less than 1.5% of the SIL for all pollutants at 50 km.

Modeled Emission Rates for Precursors

Pursuant to the DAQ guidance document "Application of the EPA's Modeled Emission Rates for Precursors (MERPs) for Secondary Pollutant Formation in Kentucky" dated August 2, 2018, (DAQ MERPs guidance) MERPs have been utilized as a Tier 1 demonstration tool for ozone and $PM_{2.5}$ since emission rates affecting those constituents are proposed to be above the applicable significant emission rates. The required ozone and $PM_{2.5}$ demonstrations are satisfied with the worst-case default MERP values listed in Table 3 of the DAQ MERPs guidance.

Table 20 Default MERP Values for Kentucky PSD Applications

Precursor	8-Hour Ozone (tpy)	Daily $PM_{2.5}$ (tpy)	Annual $PM_{2.5}$ (tpy)
NO_X	169	2,449	8,333
SO_2	-	1,500	10,000
VOC	3,333	-	-

For the evaluation of the project with respect to ozone, the sum of the project's proposed NO_X net emissions increase in tons per year (tpy) divided by the NO_X MERP (tpy) for ozone and the project's proposed VOC emissions increase (tpy) divided by the VOC MERP (tpy) is compared to the 8-hour ozone SIL of 1 ppb. If the sum, as shown in the equation below, is less than one, the project is deemed to not have a significant impact on ambient 8-hour ozone levels, and there is no need to conduct a cumulative analysis for ozone.

$$\frac{NOx\ Emission\ Rate}{NOx\ MERP} + \frac{VOC\ Emission\ Rate}{VOC\ MERP} < 1$$

Table 21 Ozone MERPs Demonstration

Averaging Period	NO_X Project Emissions (tpy)	NO_X MERP (tpy)	VOC Project Emissions (tpy)	VOC MERP (tpy)	Total	Is Total < 1?
8-hour Ozone	0	169	75.53	3,333	0.023	YES

Since the sum from the above equation is less than one, the project is deemed to not have a significant impact on ambient 8-hour ozone levels.

The applicable equation is shown below, and the max $PM_{2.5}$ Modeled Concentration is the highest value (annual or H1H 24-hour concentration averaged over five years) of direct $PM_{2.5}$ emission increases modeled using AERMOD. If the sums of the equation for both the 24-hour and annual $PM_{2.5}$ averaging periods are less than 1, the project will be deemed to not have a significant impact on ambient $PM_{2.5}$ concentrations, and there is no need to conduct a cumulative analysis for $PM_{2.5}$.

$$\frac{Max\ PM2.5\ Modeled\ Conc.}{PM2.5\ SIL} + \frac{SO2\ Emission\ Rate}{SO2\ MERP} + \frac{NOx\ Emission\ Rate}{NOx\ MERP} < 1$$

Table 22 Ozone MERPs Demonstration

Averaging Period	Max $PM_{2.5}$ Modeled Conc. (µg/m³)	$PM_{2.5}$ SIL (µg/m³)	NO_X Project Emissions (tpy)	NO_X MERP (tpy)	SO_2 Project Emissions (tpy)	SO_2 MERP (tpy)	Total	Is Total < 1?
24-Hour $PM_{2.5}$	1.1569	1.2	0	2,449	6.76	1,500	0.9686	YES
Annual $PM_{2.5}$	0.2748	0.3	0	8,333	6.76	10,000	0.9167	YES

The result of the $PM_{2.5}$ daily MERPs analysis is 0.969, and the result of the $PM_{2.5}$ annual MERPs analysis is 0.917. Since the sums from the above equations are less than one for both daily and annual $PM_{2.5}$ analyses, the project is deemed to not have a significant impact on ambient $PM_{2.5}$ levels.

Table 23 Maximum $PM_{2.5}$ Modeled Concentrations and Applicable SILs

Averaging Period	Max Modeled Concentration (µg/m³)	Secondary $PM_{2.5}$ Conc. (µg/m³)	Total $PM_{2.5}$ Conc. (µg/m³)	SIL (µg/m³)
Daily (24-hour)	1.1569	0.0045	1.1614	1.2
Annual	0.2748	0.0007	0.2755	0.3*

*Note: Section 2.1.1 of the PSD Air Quality Analysis Report received by the Division in March 2020 and updated in May 2020 provides the justification to use a $PM_{2.5}$ annual SIL of 0.3 µg/m³.

Alternate Operating Scenarios:

As part of project, the facility has requested simultaneous operation of the existing or new ethylene flare (EPN 321 and EPN 321A) at the Westlake Chemical OpCo, LP facility and Boiler #1, Boiler #4 and Boiler#6 (EPN 008, EPN 011, EPN 013) at the Westlake Vinyls, Inc.–Vinyls Plant.

Until the removal of the existing flare EU# 007 (EPN 321), the existing flare shall not be operated beyond 180 days after startup of EU# 007A (EPN 321A). Upon startup of EU# 007A (EPN 321A), the combined operating rate of EU# 007 (EPN 321) and EU# 007A (EPN 321A) shall not exceed 56.1 mmBtu/hr on a 30-day rolling average. Westlake OpCo shall keep records of the daily average individual and combined operating rates (in mmBtu/hr) and calculate a 30-day rolling average. Westlake OpCo shall send notification of the anticipated date of initial start-up of the new flare EU# 007A (EPN 321A) postmarked no more than sixty (60) days nor less than thirty (30) days prior to such date.

Simultaneous operation of EPN 011 (Boiler #4), EPN 008 (Boiler #1), and EPN 013 (Boiler #6) shall be allowed such that the combined firing rate of the 3 boilers shall not exceed 201.58 mmBtu/hr on a 24-hour average basis. In addition, within 24 months after the final issuance of final permit V-19-016, or within 180 days after startup of EPN 013, whichever is sooner, EPN 011 and EPN 008 shall be permanently shut down. This is to ensure that the decrease in NOx emissions is included in the contemporaneous period, to preclude applicability of Sections 8 through 15 of 401 KAR 51:017.

MINOR PERMIT REVISION - V-14-022 R1:

Westlake Chemical OpCo, LP had submitted two applications for modification to its facility. The following activities have been incorporated into permit V-14-022 R1: APE20160001 and APE20160002.

COMMENTS:

Westlake Chemical OpCo, LP had submitted to the Division for Air Quality (Division) two applications for modifications at the source after the issuance of permit V-14-022 on October 26, 2015. The following activities shall be incorporated into permit V-14-022 R1:

APE20160001

On January 14, 2016 the Division received an application from the source for a minor revision. Westlake Chemical OpCo, LP had submitted to the Kentucky Department of Environmental Protection (DEP) on October 9, 2015 an application for a voluntary disclosure to bring equipment leak components (e.g. pumps, valves, compressors) in the ethylene area with greater than 10 percent volatile organic compound (VOC) under the leak detection and repair (LDAR) program as described by 40 CFR 60, Subpart VVa. Table 24 shows the updated count for each component on page 22 of the permit. The application for this revision was deemed complete on March 1, 2016.

Table 24 FUG-ETH Component Count Update Summary

Previous Count	Updated Count	Component
2,602	31,908	Flanges/connectors
638	6,853	Gas/Vapor Valves
10	29	Pumps
3	23	Compressors
484	872	Light Liquid Valves
0	135	Pressure Relief Valves

APE20160002

On February 11, 2016 the Division received an application from the source for a minor revision. Westlake Chemical Corporation is proposing to install new equipment and modify existing equipment in order to expand production at the three (3) facilities – Westlake Chemical OpCo, LP (AI# 122899), Westlake Vinyls, Inc. – Vinyls Plant (AI# 2966), and Westlake Vinyls, Inc. – PVC Plant (AI# 2967). The change in Westlake OpCo includes an increase to the annual ethylene production from its baseline actual production between the years 2014 and 2015 of approximately 570 million pounds per year (lb/yr) to 755 million lb/yr. The project that included the three sources has provided emissions calculations and specific documents to show that the increased emissions do not trigger significant emissions increase requiring Prevention of Significant Deterioration (PSD) review. No changes to the permit were made from this revision as no physical changes were proposed at this source. The application was deemed complete on April 28, 2016.

APPLICABLE REGULATIONS:

401 KAR 50:012 General Application, is applicable to EU #008 (EPN 342, River VCU).

401 KAR 51:017 Prevention of significant deterioration of air quality, is applicable to EU #006C (EPN 329, Cracking Furnace #10), EU# 007A (EPN 321A, New Ethylene Flare), EPN 326A (Decoking Pot), EU #025 (FUG-ETH-YY, Ethylene Plant Fugitives), EU 025A (FUG-ETH-VVa, Ethylene Plant Fugitives subject to VVa) and EU 025B (FUG-ETH, Ethylene Plant Fugitives not in LDAR).

401 KAR 57:002, Section 1(2), *40 CFR 61, Subpart J, National emission standard for equipment leaks (fugitive emission sources) of benzene, is applicable only to equipment "in Benzene Service" for EU# 025 (EPN FUG-ETH-YY) as defined in 40 CFR 61.111 [40 CFR 61.112(b)].

*NOTE: Pursuant to 40 CFR 63.1100(g)(4), equipment that must be controlled by 40 CFR 63, Subpart YY and 40 CFR 61, Subpart J or 40 CFR 61, Subpart V, is required only to comply with the equipment leak requirements of 40 CFR 63, Subpart YY, which references 40 CFR 63, Subpart UU.

401 KAR 57:002, Section 1(2), 40 CFR 61, Subpart FF, National emission standard for benzene waste operations, is applicable to the Ethylene Wastewater Pre-treatment Plant; including tanks Ethylene Wastewater Pre-treatment Plant (EPN ET-1) – TK191, TK-195, TK-196, TK-198A, TK-198B, TK-201, Tk-202, and TK-211 and oil water separators TK-192A, TK-192B, TK-194A, TK-194B, and TK194-C, by reference from 40 CFR 63.1091 (40 CFR 63, Subpart XX).

401 KAR 59:015, New Indirect Heat Exchangers, is applicable to EU #005A-D (EPN 305 – 307 and EPN 311, Cracking Furnaces #1 – 3 and #7), EU #006A-C (EPN 327, 328 and 329, Cracking Furnaces #8-10) and EU #RRH (EPN 314, Reactor Regeneration Heater).

401 KAR 59:095, New oil-effluent water separators, is applicable to the following emission points: TK-192A; TK-192B; TK-194A; TK-194B; and TK-194C at Ethylene Wastewater Pre-treatment Plant (EPN ET-1).

401 KAR 60:002, Section 2(2)(ccc), 40 C.F.R. 60.480a to 60.489a (Subpart VVa), Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry for Which Construction, Reconstruction, or Modification Commenced After November 7, 2006, is applicable to EU# 025A (EPN FUG-ETH-VVa).

401 KAR 60:002, Section 2(2)(ppp), 40 C.F.R. 60.660 to 60.668 (Subpart NNN), Standards of Performance for Volatile Organic Compound (VOC) Emissions From Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations, is applicable to certain distillation columns vent streams in the ethylene plant which could potentially be routed to the heaters. 40 CFR 60.660(d) states the owner or operator can alternatively comply with the requirements in 40 CFR 65 Subpart D, Process Vents. Within Subpart D, 40 CFR 65.63(a)(2) references 40 CFR 65.142(b) for requirements. 40 CFR 65.142(b) is a reference within 40 CFR 65, Subpart G, Closed Vent Systems, Control Devices, and Routing to a Fuel Gas System or a Process is applicable to EU# DRH (EPN 313, Dryer Regeneration Heater), EU# RRH (EPN 314, Reactor Regeneration Heater), EU# 007 (EPN 321, existing Ethylene flare, until decommissioned) and EU# 007A (EPN 321A, New Ethylene Flare).

401 KAR 60:002, Section 2(2)(ttt), 40 C.F.R. 60.700 to 60.708 (Subpart RRR), Standards of Performance for Volatile Organic Compound Emissions from Synthetic Organic Chemical Manufacturing Industry (SOCMI) Reactor Processes, is applicable to the following vent recovery systems:

The process fuel gas burned in EU# 005A – D (EPN 305 – 307 and EPN 311), EU# 006A – C (EPN 327, 328 and 329), EU #DRH (EPN 313) and EU #RRH (EPN 314) is subject to 40 CFR 60, Subpart RRR. As allowed in 40 CFR 60.700(d), owners or operators of process vents that are subject to this subpart may choose to comply with the provisions of 40 CFR Part 65, Subpart D as described in 40 CFR 65.63(a)(2).

The cracking furnace vent streams which could potentially be routed to EU#007 (EPN 321, until decommissioned) and/or EU# 007A (EPN 321A) New Ethylene Flare. 40 CFR 60.700(d) states the owner or operator can alternatively comply with the requirements in 40 CFR 65, Subpart D, Process Vents. Within Subpart D, 65.63(a)(1) references 65.142(b) for requirements. 65.142(b) is a reference within 40 CFR 65 Subpart G, Closed Vent Systems, Control Devices, and Routing to a Fuel Gas System or a Process applies to the flare.

401 KAR 61:015, Existing Indirect Heat Exchangers, is applicable to EU #DRH (EPN 313).

401 KAR 63:002, Section 2(1), 40 C.F.R. 63.1 to 63.16, Table 1 (Subpart A), General Provisions, referencing 40 CFR 63, Subpart SS (National emission standards for Closed Vent Systems, Control Devices, Recovery Devices, and Routing to a Fuel Gas System), and 40 CFR 63, Subpart YY (National emission standard for Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology Standards), National emission standard for ethylene manufacturing, applies to EU# 007 (EPN 321) existing Ethylene Flare (until decommissioned) and EU# 007A (EPN 321A) New Ethylene Flare.

401 KAR 63:002, Section 2(4)(q), 40 C.F.R. 63.560 to 63.568 (Subpart Y), National Emission Standards for Marine Tank Vessel Loading Operations. EU# 008 (EPN 342) is part of the affected source pursuant to 40 CFR 63.561. A source means any location where at least one dock or loading berth is bulk loading onto marine tank vessels, except offshore drilling platforms and lightering operations. There are no emission standards that apply since it is considered an existing source with hazardous air pollutants (HAP) emissions of single and combined HAP less than 10 and 25 ton per year (tpy), respectively [40 CFR 63.560(a)(2)].

401 KAR 63:002, Section 2(4)(ii), 40 C.F.R. 63.980 to 63.999 (Subpart SS), National Emission Standards for Closed Vent Systems, Control Devices, Recovery Devices and Routing to a Fuel Gas System or a Process, is applicable to EU# 007 (EPN 321) existing Ethylene Flare (until decommissioned) and EU# 007A (EPN 321A) New Ethylene Flare.

401 KAR 63:002, Section 2(4)(kk) 40 C.F.R. 63.1019 to 63.1039, Table 1 (Subpart UU), National Emission Standards for Equipment Leaks - Control Level 2 Standards, is applicable to the EU# 025 (EPN FUG-ETH-YY).

401 KAR 63:002, Section 2(4)(mm), 40 C.F.R. 63.1060 to 63.1067 (Subpart WW), National Emission Standards for Storage Vessels (Tanks), is applicable to storage tanks TK-904A and TK-904B at EU# 022 (EPN 319) and EU# 022 (EPN 320), respectively.

401 KAR 63:002, Section 2(4)(nn), 40 C.F.R. 63.1080 to 63.1097, Tables 1 and 2 (Subpart XX), National Emission Standards for Ethylene Manufacturing Process Units: Heat Exchange Systems and Waste Operations, is applicable to the Ethylene Wastewater Pre-treatment Plant (EPN ET-1) by reference in 40 CFR 63, Subpart YY [40 CFR 63.1103(e)(3)(g)(1)(i)].

401 KAR 63:002, Section 2(4)(nn), 40 C.F.R. 63.1080 to 63.1097, Tables 1 and 2 (Subpart XX), National Emission Standards for Ethylene Manufacturing Process Units: Heat Exchange Systems and Waste Operations, is applicable to the No. 4 Cooling Water Tower at EU# 023 (EPN 364) by reference in 40 CFR 63, Subpart YY.

401 KAR 63:002, Section 2(4)(oo), 40 C.F.R. 63.1100 to 63.1114 (Subpart YY), National Emission Standards for Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology Standards, is applicable to:

Cracking furnaces EU# 005A – D (EPN 305 – 307 and EPN 311) and EU# 006A – C (EPN 327, 328 and 329) are part of the affected source pursuant to 40 CFR 63.1103(e)(1)(ii)(J), but there are no applicable requirements in 40 CFR 63, Subpart YY.

Existing Ethylene Flare EU# 007 (EPN 321, until decommissioned) and New Ethylene Flare EU#007A (EPN 321A) are subject to 40 CFR 63, Subpart YY. The requirements under 40 CFR 63, Subpart YY are met by following the applicable requirements under 40 CFR 63, Subpart SS.

Storage Tanks EPN 332A and EPN 332B. Pursuant to 40 CFR 63.1103(e)(1)(i)(A), 40 CFR 63, Subpart YY is applicable, but there are no applicable requirements in 40 CFR 63.1103 Table 7, due to tank size and vapor pressure of contents.

EU #21 (EPN 318, Storage Tank TK-932).
Wastewater Treatment Plant (EPN ET-1).

Fugitive Emissions EU #25 (EPN FUG-ETH-YY). Pursuant to 40 CFR 63.1103(e)(3)(f)(1), the permittee shall comply with the requirements of 40 CFR 63, Subpart UU.

401 KAR 63:002, Section 2(4)(iiii), 40 C.F.R. 63.7480 to 63.7575, Tables 1 to 13 (Subpart DDDDD), National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters, is applicable to Dryer Regeneration Heater (EPN 313) and Reactor Regeneration Heater (EPN 314).

401 KAR 63:010, Fugitive emissions, applies to EU# 023 (EPN 364).

401 KAR 63:015, Flares, applies to EU# 007 (EPN 321) existing Ethylene Flare (until decommissioned) and EU# 007A (EPN 321A) New Ethylene Flare.

Emission and Operating Caps description:

Westlake OpCo has chosen to impose maximum hourly and annual heat ratings for the following units:

Table 25: Imposed Heat rating limitations on a 24-hr and Annual basis

Emission unit	Max 24-hr average (mmBtu/hr)	Max annual average (mmBtu/hr)
005A-C (EPN 305-307)	184 each	150 each
005D (EPN 311)	105	80
006A-B (EPN 327-328)	135 each	127 each
006C (EPN 329)	184	150
RRH (EPN 314)	5.9	5.28

For each emission unit listed in Table 25, Westlake OpCo shall maintain records of the hourly consumption of natural gas, hydrogen gas and fuel gas on a pounds per hour basis, as well as the hourly heat content of the fuel gas used and its density. The hourly firing rate shall be calculated in accordance with the following equations:

$$NG_{\text{Firing Rate}}\left(\frac{\text{mmBtu}}{\text{hr}}\right)=NG_{\text{Use}}\left(\frac{\text{lb}}{\text{hr}}\right)\times 23{,}900\left(\frac{\text{Btu}}{\text{lb}}\right)\times\frac{1\text{ mmBtu}}{10^6\text{Btu}}$$

$$H_{2\,\text{Firing Rate}}\left(\frac{\text{mmBtu}}{\text{hr}}\right)=H_{2\,\text{Use}}\left(\frac{\text{lb}}{\text{hr}}\right)\times 56{,}400\left(\frac{\text{Btu}}{\text{lb}}\right)\times\frac{1\text{ mmBtu}}{10^6\text{Btu}}$$

$$FG_{\text{Firing Rate}}\left(\frac{\text{mmBtu}}{\text{hr}}\right)=FG_{\text{Use}}\left(\frac{\text{lb}}{\text{hr}}\right)\times \text{Heat Content}_{\text{Hourly}}\left(\frac{\text{Btu}}{\text{scf}}\right)\times\frac{1}{\rho_{\text{Fuel}}}\left(\frac{\text{scf}}{\text{lb}}\right)\times\frac{1\text{ mmBtu}}{10^6\text{Btu}}$$

$$\text{Actual 24-Hourly Firing Rate}\left(\frac{\text{mmBtu}}{\text{24-hr}}\right)=\frac{\sum_{n=1}^{24}\left(NG_{\text{Firing Rate}}+H_{2\,\text{Firing Rate}}+FG_{\text{Firing Rate}}\right)}{24\text{ hours}}$$

For the annual average firing rate of each unit listed in Table 25, Westlake OpCo shall maintain records of the monthly and 12-month rolling average firing rate. The actual monthly firing rate shall be based on the monthly consumption of natural gas, hydrogen gas, and fuel gas, as well as the monthly average heat content of the fuel gas and its density. The monthly average firing rate shall be calculated in accordance with the following equations:

$$NG_{\text{Firing Rate}}\left(\frac{\text{mmBtu}}{\text{month}}\right)=NG_{\text{Use}}\left(\frac{\text{lb}}{\text{month}}\right)\times 23{,}900\left(\frac{\text{Btu}}{\text{lb}}\right)\times\frac{1\text{ mmBtu}}{10^6\text{Btu}}$$

$$H_{2\,\text{Firing Rate}}\left(\frac{\text{mmBtu}}{\text{month}}\right)=H_{2\,\text{Use}}\left(\frac{\text{lb}}{\text{month}}\right)\times 56{,}400\left(\frac{\text{Btu}}{\text{lb}}\right)\times\frac{1\text{ mmBtu}}{10^6\text{Btu}}$$

$$FG_{\text{Firing Rate}}\left(\frac{\text{mmBtu}}{\text{month}}\right)=FG_{\text{Use}}\left(\frac{\text{lb}}{\text{month}}\right)\times HC_{\text{Monthly}}\left(\frac{\text{Btu}}{\text{scf}}\right)\times\frac{1}{\rho_{\text{Fuel}}}\left(\frac{\text{scf}}{\text{lb}}\right)\times\frac{1\text{ mmBtu}}{10^6\text{Btu}}$$

$$\text{Actual Monthly Firing Rate}\left(\frac{\text{mmBtu}}{\text{month}}\right)=\sum\left(NG_{\text{Firing Rate}}+H_{2\,\text{Firing Rate}}+FG_{\text{Firing Rate}}\right)$$

Westlake OpCo must keep records of the actual maximum hourly firing rate on a 24-hour average basis and actual annual average firing rate on a 24-month rolling basis.

For the existing and new Ethylene flares (EU# 007 and EU# 007A, EPN 321 and EPN 321A), EU# 007 shall not be operated beyond 180 days after startup of EU# 007A, and the combined operating rate of EU#007 and EU# 007A shall not exceed 56.1 mmBtu/hr on a 30-day rolling average. Westlake OpCo shall keep records of the daily average individual and combined rates of EU# 007 and EU# 007A and calculate a 30-day rolling average. Westlake OpCo shall also send notification of the anticipated date of initial start-up of EU# 007A not more than sixty (60) days nor less than thirty (30) days prior to such date.

PERIODIC MONITORING:
None

OPERATIONAL FLEXIBILITY:
As mentioned above in **Emission and Operating Caps description**, Westlake OpCo has the operational flexibility to use both the new and existing flares (EU# 007 and EU# 007A) as long as they do not exceed the combined operating rate of 56.1 mmBtu/hr on a 30-day rolling average.

As mentioned in the Flare BACT analysis, the final design has not been chosen for the new flare EU# 007A (EPN 321A), and Westlake OpCo may choose to install a ground flare over an elevated flare. Both a ground flare and elevated flare have been modeled, and a BACT analysis has been performed using both designs.